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SORTER DEVICE

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SORTER DEVICE

The present invention relates to a device for directionally guiding articles of different shapes that are being conveyed on a conveyor off the conveyor using a movable gate that is controllable to move across the conveyor at an angle to the direction of travel of the article on the conveyor.

Such devices are well known in many contexts, but often have the common characteristic that the articles are slowed unduly by the gate, especially if the gate forms a large angle with the direction of travel of the conveyor.

Therefore, there has long been a need to be able, in an effective and simple manner, to remove articles from a conveyor using a movable gate so as to ensure an efficient removal.

According to the invention, the device is therefore characterised in that the gate is made having a means which, upon movement of the gate across the conveyor, is designed to forcibly cause the article to be driven along the gate, in a direction corresponding to said angle, off the conveyor and to an exit, and that the means consists of at least one motor-driven rotatable disc, preferably equipped with a friction surface.

Other embodiments of the device will be apparent from the attached subsidiary claims and from the following description with reference to the attached drawings.

In the following drawings, the phrase "sorting to the left" means that the device causes sorting to the left-hand side seen in relation to the direction of travel of the conveyor. Similarly, the phrase "sorting to the right" will be related to the direction of travel of the conveyor.

In the attached drawings, the different embodiments of the device are shown as typical exemplary embodiments which could be modified without thereby deviating from the inventive idea.

Figure 1 shows a device for sorting to the left, with the gate at a first angle relative to the direction of travel of the conveyor.

Figure 2 shows the device for sorting to the left, with the gate at a second angle relative to the direction of travel of the conveyor.

Figure 3 shows the device intended for sorting to the left, with the gate at a third angle.

Figure 4 shows the device for sorting to the right, with the gate at a second angle relative to the direction of travel of the conveyor.

Figure 5 shows a detail of the device for sorting to the left shown for a first angle relative to the direction of travel of the conveyor.

Figure 6 is a sectional view of a part of Figure 5 with a cover removed to reveal structural details.

Figure 7 shows the device intended for sorting to the right at a third angle relative to the direction of travel of the conveyor.

Figure 8 shows the device for sorting to the right with the gate placed at a first angle relative to the direction of travel of the conveyor.

Figure 9, like Figure 6, shows internal parts of the device intended for sorting to the left, and with the gate positioned at a second angle relative to the conveyor.

Figure 10 shows the device according to the invention in cooperation with a reverse vending machine for articles in the form of empties, for example, bottles or cans.

Figure 11 shows a further embodiment of the device according to the invention.

Figure 12 is a block diagram intended to visualise control of the device according to Figure 10.

Figs. 13a-13d show alternative angular positions for the embodiments shown in Figures 1-10.

Figures 14a-14g show alternative angular positions for the embodiment shown in Fig. 11.

Figs. 15a-15c are images of the device essentially according to Fig. 11 in a first angular position.

Figs. 16a-16b are images of the device essentially according to Fig. 11 in a second angular position.

Fig. 17 is an image of the device essentially according to claim 11 in a third angular position.

Figure 1 shows an exemplary embodiment of the device according to the invention, wherein a conveyor 1 is provided, equipped in the preferred example with two belt halves 1', 1" which are run at the same speed by a motor 4 via a drive element 5, for example, a belt or a chain. Alternatively, the motor may be directly connected, as shown in the case of the motor 65 in Figure 15. The two conveyor belt parts 1, 1" together form a V-shape so that articles conveyed on the conveyor 1 remain in place. Thus, a conveyor of this kind will be particularly suitable for conveying lying articles, such as empty bottles or empty cans, although the device can be used for other types of articles that are to be conveyed off the conveyor 1.

Transverse to the conveyor 1 there may be, for example, for sorting articles to the left, a conveyor 2 that is driven by a motor 39 (Figure 15) and where the conveyor 2 is pretensioned by tensioning blocks 7, 7'. Side walls 6, 6' and a central dividing wall 6" are found in connection with the conveyor 2. In the illustrated example in Figure 1, the gate is formed of a rotatable disc 8, preferably provided with a friction surface on the side that is to face the article to be moved away. The rotational movement of the rotatable disc can be caused by a motor 9 via a bevel gear drive 10. Alternatively, the motor may be connected directly to the disc. The motor-driven, rotatable disc is supported on an angle arm 11 that is rotatably connected to a supporting structure 12. Detectors 13, 14 are provided for detecting the angular position of the gate, in this case the disc 8, relative to the direction of travel of the conveyor 1. The angle arm 11 cooperates with an auxiliary gate or guide flap 15. The angle arm 11, and thus the gate in the form of the disc 8 are caused 16 to turn by a motor 23 via a drive pulley 24 and transmission 25 to a turning platform to which the angle arm 11 is fixed. At the same time, a flag device 17 that is associated with the turning platform 16 will cause movement of the auxiliary gate 15. This auxiliary movement is provided via articulation 17', connecting arm 18, articulation 18' and an arm 19 in connection with a rotatable post 19' to which said auxiliary gate 15' is secured. The flag device 17 has

flags 20, 21, 22 and 26 for detecting, with the aid of the detectors 13, 14, the angular position that the gate or disc 8 is in relative to the direction of travel of the conveyor. Although the motor 23 can be controlled to allow the angle arm 11, and thus the disc 8, to assume the correct angular position relative to the direction of travel of the conveyor, the detectors 13, 14, in cooperation with the position flags 20, 21, 22 and 26, are nevertheless important for ensuring at all times that the correct position has been obtained. The flag device 17, together with the detectors 13, 14 may be optical, electromagnetic, capacitive or electromechanical. In the preferred exemplary embodiment of the invention, the flag device is electromagnetic. As shown in Figure 2, the angle arm 11 is mounted on a base or a supporting structure 12 consisting of a bottom part 27 and a top part 27', as shown in Figure 5. In Figure 6, the top part 27' has been removed for the sake of clarity.

Guide walls 3, 3' and 3" are also provided at each device to ensure that the article, when guided off the conveyor 1, does not accidentally roll off the conveyor 1 as a consequence of the angular position of the gate relative to the conveyor.

Figure 4 shows the device according to the invention prepared for sorting to the right relative to the conveyor 1. In the illustrated case, the gate is represented by a rotatable disc 28, preferably equipped with a friction surface, in the same way as the disc 8. As shown in Figures 7 and 8, the disc 28 is driven by a motor 29 via a bevel gear drive 29'. Alternatively, the position of the bevel gear drive 29' could be replaced by a motor (not shown), which thus could be directly connected to the disc 28. As illustrated, the disc 28 is supported by an angle piece 30 that is mounted on a turning platform 31, which turning platform 31 is supported on a base or a supporting structure 32, 32'. The locational angular position of the gate or the disc 28 relative to the direction of travel of the conveyor 1 is detectable by means of detectors 33, 34 which correspond to the detectors 13, 14 as described above. To prevent the article that is to be conveyed off the conveyor 1 from accidentally rolling off the conveyor 1, guide walls 35, 36, 36' are provided as shown in Figure 4. Like the guide walls 3-3" as shown in Figures 1-3, these walls also prevent articles from being accidentally caught on, for example, the gate 8 or an edge of the wall 37'. Transverse to the conveyor 1 there is, for sorting to the right, a conveyor 60 which is driven by a motor 60'. Guide walls 37, 37' and partition wall 37" are found in connection with the conveyor 60.

In the illustrated example, the conveyor 60 runs to a compactor and/or a disintegrator 38 which has two compartments 38', 38". These two compartments 38' and 38" are

preferably constructed differently, but operated by a common drive unit 39. A first exit from the gate 8 is thus defined by guide walls 37, 37" and a second exit is defined by the guide walls 37', 37".

An after-treatment unit in the form of a two-chamber compactor and/or disintegrator is known per se, but not in connection with a device as shown and described in connection with Figures 1-9.

In Figures 1-9, the rotatable disc is shown with a lying, preferably horizontal axis of rotation. However, this should not be regarded as limiting since the disc may alternatively have a non-horizontal axis of rotation.

As shown in Figures 1-9, the gate with its moving means is controllable to assume at least three angularly different positions relative to the conveyor 1.

As shown in Fig. 10, and with reference to the preceding figures, the gate will be arranged to guide articles to an exit, and where, with the aid of the controllable gate, it is possible to select the exit from between at least a first and a second exit, as is also clear from Figure 10. In the illustrated example in Figure 10, the exits in connection with the conveyor 2 lead via an after-treatment unit 38 to receptacles 41, 42. The after-treatment unit 38 may, as shown and described above, optionally consist of a compactor and/or disintegrator. Receptacles 43, 44 will also be arranged in connection with the conveyor 60.

As mentioned above, the conveyor 1 may optionally be driven by a motor 45. The turning of the angle arm 30 and thus the gate 28 can be effected by a motor 46.

In the illustrated exemplary embodiment in Figure 10 there is also provided a feed-in unit 47, for example, a return vending machine for articles in the form of boxes 30 and/or bottles 31. The reverse vending machine 47 has a detector unit 48 for identifying or detecting features or parameters related to the individual article 30, 31 such as shape, weight or size, and possibly other identifying features such as bar codes or other markings. The reverse vending machine 47 has, in addition. a processor and a control unit 49 which cooperates with the detector unit 48. Thus, the reverse vending machine will, on the basis of the detection of an article, give the moving means of the gate, as for example, the disc 8, a working speed at which the means makes contact with the article that is a function of the angle the gate is to form with the direction of travel of the

conveyor 1. Thus, the working speed of said means could be a function of the weight, size and/or shape of the article, or other characteristic features, for example, a bar code.

The working speed of the moving means may also be a function of the working speed of the conveyor 1, and it is advantageous that the working speed of the moving means is equal to or greater than the working speed of the conveyor. In a preferred embodiment, the disc 8 may be arranged so as to be able to cause the article to be given accelerated movement off the conveyor belt.

As will be understood with reference to Figures 6 and 9, the auxiliary gate 15 will be arranged so that when the gate itself is turned, it assumes a desired angular position essentially parallel to the gate and at a distance therefrom adapted to be able to guide the article through a space between the gate and the auxiliary gate.

The detector unit 48 in the reverse vending machine 47 is, as shown in Figure 10, arranged upstream of the gates 8, 28 for identifying or detecting the characteristic features or parameters that the article has. On the basis of identified or detected features or parameters, the device, via the processor and control unit 49, will be arranged to control the gate to assume the desired angular position relative to the conveyor. The unit 49 will also be able to control the working speed of, for example, the discs 8 or 28 relative to the working speed of the conveyor and/or the angular position of the gate.

As shown in Figure 10, the motor 39 communicates with the unit 49 via control 52. However, this control may be based on continuous operation of the motor 39. The motor 9 which drives the disc 8 is controlled from the unit 49 via control line 53. Control line 54 from the unit 49 is arranged to actuate the motor 23 and thus govern the angular position of the disc 8 relative to the direction of travel of the conveyor 1. Control line 55 from the unit 49 runs to a drive motor 2' for the conveyor 2. The control in this case may be based on continuous operation of the conveyor 2, but it will also be possible, with the aid of the unit 49, to regulate the rotation of the motor 2' and thus the working speed of the conveyor 2.

Control line 56 from the unit 49 runs to the motor 46 which controls the angular position of the gate 28 relative to the conveyor.

Control line 57 is passed from the unit 49 to the motor 29 which operates the disc or gate 28.

Control line 58 extends from the unit 49 to the motor 45 to regulate the speed of the conveyor 1 if this is desirable.

Control line 59 from the unit 49 controls the drive motor 40' for the conveyor 40. Control line 60 from the unit 49 runs to a drive motor 39 for the after-treatment unit 38 that is mounted in connection with the conveyor 40. The after-treatment unit 38 and the motor 39 in connection with the conveyor 40 will preferably be of the same general design and function as the unit 38 and the motor 39 in connection with the conveyor 2.

The line 61 connects the detector 13, 14 with the unit 49. In a similar way, the detectors 33, 34 will be connected to the unit 49 via line 62.

The further embodiment shown in Figure 11 has two motor-driven discs 63, 64 that are driven by a motor 66, wherein the space between the discs 63, 64 is adapted to the width of the conveyor in such manner that articles can pass unobstructed between the discs when the pair of discs 63, 64 is in a first position, parallel to the direction of travel of the conveyor. In Figure 11, the pair of discs is shown in a second angular position. The discs 63, 64 have a common drive shaft and are mounted on a frame 69, 69', 69" which has a motor 70 that causes controlled turning of a suspension bracket 65 for the pair of discs 63, 64. Operation of the pair of discs is effected from the motor 66 via gear and power transmission 67, 68. The operation of the motor 66 is advantageously continuous, but may be discontinuous. The angular position that the pair of discs 63, 64 assumes will be determined by the unit 49 via the controlled motor 70. The axis of rotation of the bracket 65 will advantageously be orthogonal to the longitudinal, central axis of the conveyor 1. It is of course conceivable that the motor could be replaced by a solenoid with controllable arms for moving the bracket 65. Similarly, the motor 66 may be expediently controlled via the unit 49; see Fig. 17.

As shown in Fig. 11, it is conceivable that articles are passed out via the exit 72 or the exit 71, 71', 71", or optionally passed onwards through the discs 63, 64 towards the end of the conveyor 1.

Figs. 13a-13d show a single gate 73 in a first position in which it can allow articles to move forwards on the conveyor belt 1 towards an exit 74. In a second position as shown in Fig. 13b, the gate 73 is capable of guiding an article towards an exit 75. In a third position as shown in Figure 13c, the gate 73 is capable of guiding an article

towards an exit 76. In a fourth position as shown in Figure 13d, the gate 73 is capable of guiding an article towards an exit 77 on the opposite side of the conveyor.

Between the positions in, for example, Figure 13c and Figure 13d, the gate must move across a large angle of almost 120° in order to have the capability of sorting to both sides of the conveyor 1. The range of movement will also be large. The solution with the single disc is therefore most appropriate for sorting, for example, to just one side of the conveyor 1.

In the solution shown in Figs. 14a-14c and which in one embodiment corresponds to that shown in Fig. 11, there is a simultaneously moving pair of rotatable gates 78, 79, for example, corresponding to the discs 63, 64 in the embodiment shown in Fig. 11. The angular position of the pair of gates 78, 79 relative to the conveyor is controlled from the unit 49 via a motor 70. The axis of rotation for the angular adjustability of the pair of gates will advantageously be orthogonal to the longitudinal central axis of the conveyor. The pair of gates advantageously has twin drive or synchronised drive, for example, provided by a motor 66.
In a first position, as shown in Figure 14a, the pair of gates 78, 79 is parallel to the length of the conveyor. Thus, articles will, with the aid of the conveyor 1, move between the gates 78, 79 and towards an exit 80.

In a second position of the pair of gates 78, 79 as shown in Figure 14b, articles will be guided towards an exit 81 on one side of the conveyor by the gate 79, whilst in a third position as shown in Figure 14c, the gate 79 of the pair of gates will guide articles towards an exit 82.

The solution shown in Figures 11 and 14a-14c is especially suitable for sorting straight ahead or to both sides of the conveyor. This permits simple standardisation of the gate solution, and avoids a mirror version of the mounting equipment for the gate solution shown in Figures 1-10 and 13.

If the gate exits for a solution as shown in Figure 14 are designed to be exits divided by a wall or the like at a slightly greater distance from the conveyor 1 than that shown in Figures 14b and 14c, as shown in Figures 14d-14g, there will be a possibility of having two exits 83, 84, or 85, 86 on each side of the conveyor, in addition to the possibility of the conveying of articles straight on towards the exit 80. This gives a unique option for sorting at each gate unit.

The solution shown in Figures 14d-14g thus permits a total of five sorting solutions. With, for example, two such units positioned one after the other, it will be possible for articles to be moved with the aid of two controllable units to a total of nine exits. This means that the solution in Figures 13a-13d give a maximum of 3n + 1 sorting options, but usually 2n + 1; the solution in Figures 14a-14c give 2n + 1 sorting options, and the solution in Figures 14d-14g fives 4n + 1 sorting options, wherein n is the number of units of the type in question.

Figures 15a-15c show a photograph of a prototype solution as outlined in Figure 10 and Figure 14, wherein a bottle 87 is conveyed straight ahead on the conveyor 1 between the discs 63, 64.

In Figures 16a-16b, the discs have been turned to a second angular position, and the disc 63 guides, for example, a bottle 88 off the conveyor towards an exit 89.

In Figure 17, the discs have been turned to a third angular position, so that the disc 74 guides, for example, an empty beverage can 90 off the conveyor 1 to an exit 91, for example, a chute.

Although the illustrated device will generally be useful for many types of articles that are to be moved on a conveyor and at chosen points guided off the conveyor, the device according to a preferred application is used for sorting articles in the form of empties, for example, bottles or cans.